

NAKATSU et al
Appl. No. 09/373,544
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AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A light-emitting diode comprising:
a semiconductor substrate; and
a layered structure comprising an AlGaInP type compound semiconductor material and provided on the semiconductor substrate,
wherein the layered structure comprises:
a light-emitting structure composed of a pair of cladding layers and an active layer for emitting light provided between the pair of cladding layers; and
a current diffusion layer comprising an AlGaInP type material which is lattice-mismatched with the light-emitting structure, wherein a lattice mismatch $\Delta a/a$ of the current diffusion layer with respect to the light-emitting structure defined by the following expression is -1% or smaller:
$$\Delta a/a = (a_d - a_e)/a_e$$
where a_d is a lattice constant of the current diffusion layer, and a_e is a lattice constant of the light-emitting structure, and
wherein crystal of the semiconductor substrate is inclined by 8° (degrees) to 20° (20 degrees) in a ~~{110}~~[011] direction with respect to a (100) plane thereof.

2. (Cancelled)

3. (Previously Presented) A light-emitting diode according to claim 1, wherein a composition of the current diffusion layer is selected in such a manner that the current diffusion layer becomes transparent with respect to a wavelength of light emitted from the light-emitting structure.

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4. (Previously Presented) A light-emitting diode according to claim 1, wherein a composition of the current diffusion layer is expressed as $(Al_xGa_{1-x})_yIn_{1-y}P$, and x is set in the range of 0.01 to 0.05 and $1-y$ is set in the range of 0.01 to 0.30 in the composition.

5. (Previously Presented) A light-emitting diode comprising:
a semiconductor substrate; and
a layered structure comprising an AlGaInP type compound semiconductor material and provided on the semiconductor substrate,
wherein the layered structure comprises:
a light-emitting structure composed of a pair of cladding layers and an active layer for emitting light provided between the pair of cladding layers; and
a current diffusion layer comprising an AlGaInP type material which is lattice-mismatched with the light-emitting structure, wherein a lattice mismatch $\Delta a/a$ of the current diffusion layer with respect to the light-emitting structure defined by the following expression is -1% or smaller:

$$\Delta a/a = (a_d - a_e)/a_e$$

where a_d is a lattice constant of the current diffusion layer, and a_e is a lattice constant of the light-emitting structure, and

wherein a composition of the current diffusion layer is expressed as $(Al_xGa_{1-x})_yIn_{1-y}P$, and at least one of a value of x and a value of $1-y$ in the composition varies along a thickness direction of the layered structure.

6. (Previously Presented) A light-emitting diode comprising:
a semiconductor substrate; and
a layered structure comprising an AlGaInP type compound semiconductor material and provided on the semiconductor substrate,
wherein the layered structure comprises:

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a light-emitting structure composed of a pair of cladding layers and an active layer for emitting light provided between the pair of cladding layers; and

a current diffusion layer comprising an AlGaInP type material which is lattice-mismatched with the light-emitting structure, wherein a lattice mismatch $\Delta a/a$ of the current diffusion layer with respect to the light-emitting structure defined by the following expression is -1% or smaller:

$$\Delta a/a = (a_d - a_e)/a_e$$

where a_d is a lattice constant of the current diffusion layer, and a_e is a lattice constant of the light-emitting structure, and

wherein a composition of the current diffusion layer is expressed as $(Al_xGa_{1-x})_yIn_{1-y}P$, and at least one of a value of x and a value of $1-y$ in the composition decreases in a step-like manner along a thickness direction of the layered structure from an interface with the light-emitting structure toward opposite end of the current diffusion layer.

7. (Previously Presented) A light-emitting diode comprising:

a semiconductor substrate; and

a layered structure comprising an AlGaInP type compound semiconductor material and provided on the semiconductor substrate,

wherein the layered structure comprises:

a light-emitting structure composed of a pair of cladding layers and an active layer for emitting light provided between the pair of cladding layers; and

a current diffusion layer comprising an AlGaInP type material which is lattice-mismatched with the light-emitting structure, wherein a lattice mismatch $\Delta a/a$ of the current diffusion layer with respect to the light-emitting structure defined by the following expression is -1% or smaller:

$$\Delta a/a = (a_d - a_e)/a_e$$

where a_d is a lattice constant of the current diffusion layer, and a_e is a lattice constant of the light-emitting structure, and

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wherein a composition of the current diffusion layer is expressed as $(Al_xGa_{1-x})_yIn_{1-y}P$, and at least one of a value of x and a value of $1-y$ in the composition varies in a step-like manner along a thickness direction of the layered structure from an interface with the light-emitting structure toward opposite end of the current diffusion layer, thereby controlling a resistivity of the current diffusion layer in the thickness direction.

8. (Previously Presented) A light-emitting diode according to claim 5, wherein both the values of x and $1-y$ in the composition of the current diffusion layer vary, independent of each other.

9. (Previously Presented) A light-emitting diode according to claim 6, wherein both the values of x and $1-y$ in the composition of the current diffusion layer decrease, independent of each other.

10. (Previously Presented) A light-emitting diode according to claim 7, wherein both the values of x and $1-y$ in the composition of the current diffusion layer vary, independent of each other.

11. (Canceled)

12. (Canceled)

13. (Canceled)

14. (Canceled)

15. (Cancelled)

16. (Cancelled)